

## Amendments to the Claims

- [0001] (Presently Amended, Once) A method for determining a molecular property of each constituent in a mixture of hydrocarbons in a portion of earth formation surrounding a borehole comprising:  
    generating a static magnetic field in a portion of earth formation surrounding a borehole;  
    producing an rf magnetic field in the portion of earth formation;  
    measuring nuclear magnetic resonance signals from the portion of earth formation;  
    deriving at least one dynamic parameter for each constituent in the mixture from nuclear magnetic resonance signals ~~data measured on the mixture~~; and  
    calculating aat least one molecular property selected from the list of molecular size distributions, molecular weight distributions and carbon number distributions ~~for the each constituent in~~ the mixture from the at least one dynamic parameter for each constituent.
- [0002] (Original) The method of claim 1, wherein the deriving the at least one dynamic parameter comprises generating a model that includes a plurality of components for the constituents of the mixture and iteratively modifying the model components to optimize the model with respect to the nuclear magnetic resonance data.
- [0003] (Original) The method of claim 1, wherein the at least one dynamic parameter comprises one selected from a longitudinal relaxation time, a transverse relaxation time, a ratio of longitudinal to transverse relaxation time, and a diffusion rate.
- [0004] (Original) The method of claim 1, wherein the mixture of hydrocarbons is disposed in a geological formation.
- [0005] (Original) The method of claim 1, wherein the calculating the molecular property for the each constituent in the mixture from the at least one dynamic parameter comprises correlating the at least one dynamic parameter of the each constituent with an effective viscosity of the each constituent.
- [0006] (Original) The method of claim 5, wherein the correlating comprises deriving empirical parameters from a suite of hydrocarbon samples.

- [0007] (Original) The method of claim 6, wherein the suite of hydrocarbon samples comprises crude oils.
- [0008] (Original) The method of claim 1, wherein the calculating the molecular property comprises using a neural network.
- [0009] (Presently Amended, Once) A method for determining a molecular property of each constituent in a mixture of hydrocarbons in a portion of earth formation surrounding a borehole, comprising:  
generating a static magnetic field in a portion of earth formation surrounding a borehole;  
producing an rf magnetic field in the portion of earth formation;  
measuring nuclear magnetic resonance ~~data of the mixture~~ signals from the portion of earth formation;  
deriving at least one dynamic parameter for the each constituent in the mixture from the nuclear magnetic resonance ~~data~~signals; and  
calculating ~~at least one~~ molecular property selected from the list of molecular size distributions, molecular weight distributions and carbon number distributions for the ~~each constituent in the mixture~~ from the at least one dynamic parameter for the each constituent.
- [0010] (Original) The method of claim 9, wherein the deriving the at least one dynamic parameter comprises generating a model that includes a plurality of components for the constituents of the mixture and iteratively modifying the model components to optimize the model with respect to the nuclear magnetic resonance data.
- [0011] (Original) The method of claim 9, wherein the at least one dynamic parameter comprises one selected from a longitudinal relaxation time, a transverse relaxation time, a ratio of longitudinal to transverse relaxation time, and a diffusion rate.
- [0012] (Original) The method of claim 9, wherein the mixture of hydrocarbons is disposed in a geological formation.
- [0013] (Original) The method of claim 9, wherein the calculating the molecular property for the each constituent in the mixture from the at least one dynamic parameter

comprises correlating the at least one dynamic parameter of the each constituent with an effective viscosity of the each constituent.

[0014] (Original) The method of claim 13, wherein the correlating comprises deriving empirical parameters from a suite of hydrocarbon samples.

[0015] (Original) The method of claim 14, wherein the suite of hydrocarbon samples comprises crude oils.

[0016] (Original) The method of claim 9, wherein the calculating the molecular property comprises using a neural network.

[0017] (Original) The method of claim 9, wherein the measuring nuclear magnetic resonance data comprises using one tool selected from a wireline nuclear magnetic resonance tool, a logging while-drilling nuclear magnetic resonance tool, and a modular formation dynamics tester or a laboratory nuclear magnetic resonance instrument

[0018] (Presently Amended, Once) A method of well logging comprising:  
moving a nuclear magnetic resonance tool along a wellbore;  
generating a static magnetic field in a portion of earth formation;  
producing an rf magnetic field in the portion of earth formation;  
making nuclear magnetic resonance measurements of a mixture of hydrocarbons  
in the portion of earth formation;  
deriving at least one dynamic parameter for each constituent in the mixture from  
the nuclear magnetic resonance measurements; and  
calculating aat least one molecular property selected from the list of molecular  
size distributions, molecular weight distributions and carbon number  
distributions ~~for the each constituent in~~ the mixture from the at least one  
dynamic parameter for each constituent.

[0019] (Original) The method of claim 18, wherein the deriving the at least one dynamic parameter comprises generating a model that includes a plurality of components for the constituents of the mixture and iteratively modifying the model components to optimize the model with respect to the nuclear magnetic resonance measurements.

- [0020] (Original) The method of claim 18, wherein the at least one dynamic parameter comprises one selected from a longitudinal relaxation time, a transverse relaxation time, a ratio of longitudinal to transverse relaxation time, and a diffusion rate.
- [0021] (Original) The method of claim 18, wherein the calculating the molecular property for the each constituent in the mixture from the at least one dynamic parameter comprises correlating the at least one dynamic parameter of the each constituent with an effective viscosity of the each constituent.
- [0022] (Original) The method of claim 21, wherein the correlating comprises deriving empirical parameters from a suite of hydrocarbon samples.
- [0023] (Original) The method of claim 22, wherein the suite of hydrocarbon samples comprises crude oils.
- [0024] (Original) The method of claim 18, wherein the calculating the molecular property comprises using a neural network.
- [0025] (Original) The method of claim 18, wherein the nuclear magnetic resonance tool comprises one selected from a wireline nuclear magnetic resonance tool, a logging while-drilling nuclear magnetic resonance tool, and a modular formation dynamics tester.
- [0026] (Presently Amended, Once) A method for determining molecular property distribution in a liquid sample, comprising:  
obtaining in a downhole sampling tool a liquid sample from a earth formation;  
performing nuclear magnetic resonance measurements on the liquid sample;  
determining a nuclear magnetic resonance parameter distribution of the liquid sample, wherein the nuclear magnetic resonance parameter comprises one selected from longitudinal relaxation time, transverse relaxation time, a ratio of longitudinal to transverse relaxation time, and a diffusion rate; and  
calculating aat least one molecular property selected from the list of molecular size distributions, molecular weight distributions and carbon number distributions for the liquid sample from the nuclear magnetic resonance parameter distribution.

**[0027]** (Original) The method of claim 26, wherein the calculating comprises correlating the nuclear magnetic resonance parameter of each constituent in the liquid sample with an effective viscosity of the each constituent.

**[0028]** (Original) The method of claim 27, wherein the correlating comprises deriving empirical parameters from a suite of hydrocarbon samples.

**[0029]** (Original) The method of claim 28, wherein the suite of hydrocarbon samples comprises crude oils.

**[0030]** (Original) The method of claim 26, wherein the calculating comprises using a neural network.

**[0031]** (Original) The method of claim 26, wherein the liquid sample comprises hydrocarbons.